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(54) Asymmetric radiant electric heater with multiple heating zones

(57) An asymmetric radiant electric heater has multiple heating zones which can be arranged in a plurality of configurations. The heater comprises a dish-like support (1) having two orthogonal axes of symmetry (2, 3), a base (4) of thermal and electrical insulation material in the dish-like support, a first heating element (5) and a second heating element (6) supported adjacent one another on a major surface of the base and forming an asymmetric arrangement in the dish-like support, a terminal block (7) secured at a fixed location at an edge of the dish-like support, and a wall arrangement (11) of thermal insulation material supported on the base and comprising a peripheral wall (12) extending around the heater and a dividing wall (13), integral therewith, extending between the adjacent first and second heating elements (5, 6) to form at least two asymmetric heating zones. The wall arrangement (11) is adapted and arranged to cooperate with the base (4) and the terminal block (7) whereby the wall arrangement is fitted to the heater in a first position to accommodate a first configuration of the adjacent first and second heating elements (5, 6) and in a second position, representing 180 degrees of rotation of the wall arrangement from the first position about an axis perpendicular to a base of the dish-like support, to accommodate a second configuration comprising a mirror image arrangement of the adjacent first and second heating elements (5, 6).

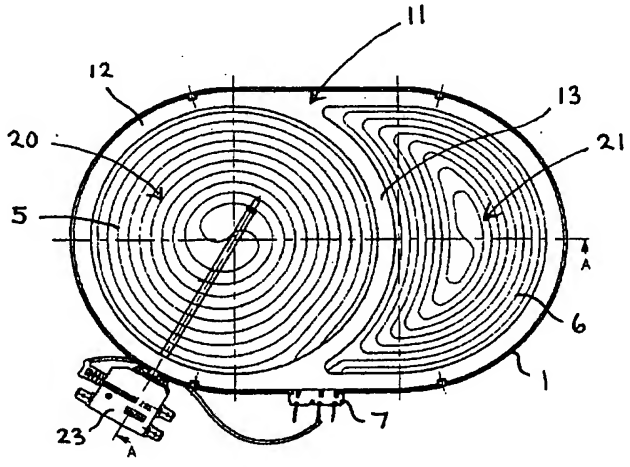

FIG. 8

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Description

[0001] This invention relates to an asymmetric radiant electric heater with multiple heating zones.

[0002] Asymmetric radiant electric heaters, for example oval heaters, with multiple heating zones are known, for example, from GB-A-2 044 057 in which an additional part-circular heated area is arranged to one side of the conventional circular heated area. In practice, the additional part-circular heated area can be arranged either to the left-hand side or to the right-hand side of the circular aréa. A significant disadvantage of such known oval heaters is that it is necessary to engineer, or tool, the left-hand and right-hand additional areas as separate products. It is also necessary to stock separate components for use in left- and right-handed heaters.

[0003] It would result in a significant saving in terms of investment and storage if the same components could be used for both left-and right-handed heaters.

[0004] It is therefore an object of the present invention to provide an asymmetric radiant electric heater with multiple heating zones in which the same components can be used for multiple configurations.

[0005] According to the present invention there is provided an asymmetric radiant electric heater with multiple heating zones which can be arranged in a plurality of configurations, the heater comprising:

a dish-like support having two orthogonal axes of symmetry;

a base of thermal and electrical insulation material in the dish-like support;

a first heating element and a second heating element supported adjacent one another on a major surface of the base and forming an asymmetric arrangement in the dish-like support;

a terminal block secured at a fixed location at an edge of the dish-like support;

a wall arrangement of thermal insulation material supported on the base and comprising a peripheral wall extending around the heater and a dividing wall, integral therewith, extending between the adjacent first and second heating elements to form at least two asymmetric heating zones;

the wall arrangement being adapted and arranged to cooperate with the base and the terminal block whereby the wall arrangement is fitted to the heater in a first position to accommodate a first configuration of the adjacent first and second heating elements, and in a second position, representing 180 degrees of rotation of the wall arrangement from the first position about an axis perpendicular to a base of the dish-like support, to accommodate a second configuration comprising a mirror image arrangement of the adjacent first and second heating elements.

[0006] The dish-like support may be of substantially oval shape.

[0007] The first heating element may be of substantially circular configuration with the second heating element being of substantially part-circular configuration.

[0008] The dish-like support may have a long axis of symmetry and a short axis of symmetry and the terminal block may be secured at the edge of the dish-like support on the short axis of symmetry. The wall arrangement may have a long axis of symmetry corresponding to the long axis of symmetry of the dish-like support.

[0009] The base of thermal and electrical insulation material may be dished. The lower edge of the dividing wall may be profiled to correspond to the dish-shape of the base.

[0010] A recess may be provided in the peripheral wall at each end of the dividing wall at a lower edge of the wall arrangement to selectively accommodate electrical connections between the terminal block and one or more of the first and second heating elements.

[0011] A protrusion may be provided on the surface of the base of thermal and electrical insulation material directly opposite to where the electrical connections to the terminal block are provided and cooperating with an overlying one of the recesses at the end of the dividing wall to substantially fill such one of the recesses.

[0012] A pair of matching elongate projections may be provided directly opposite each other on opposite lower edges of an outer rim of the peripheral wall of the wall arrangement, one of the projections being arranged to bear on the terminal block, the other of the projections being accommodated in a substantially complementary recess provided in the base layer of thermal and electrical insulation material.

[0013] A rod-like temperature-responsive device may be provided at least partly crossing one of the heating zones.

[0014] The wall arrangement may comprise bound vermiculite.

[0015] The base may comprise microporous thermal and electrical insulation material.

[0016] The first heating element and the second heating element may comprise wire, ribbon, foil or film material. In particular, the first heating element and the second heating element may comprise corrugated ribbons supported edgewise on the base of thermal and electrical insulation material.

[0017] As a result of the present invention, a standard base component can be provided for a radiant heater, consisting of a dish-like support containing a base layer of insulation material and arranged to be fitted with a terminal block at a fixed symmetrical location. Asymmetric heating elements can be arranged on the base layer in a particular configuration, or a mirror image thereof.

A single wall member is provided which, by simple orientation into a selected one of two positions, can be fitted to the base component to accommodate a particular arrangement of asymmetric heating elements, or a mirror image arrangement thereof.

[0018] For a better understanding of the present invention and to show more clearly how it may be carried into effect reference will now be made, by way of example, to the accompanying drawings in which:

Figure 1 is a top plan view of one embodiment of a base component of an asymmetric radiant electric heater according to the present invention in which a part-circular heating element is positioned to the right hand side of a circular heating element;

Figure 2 is a cross-sectional view of the heater base component shown in Figure 1 along the line A - A in Figure 1;

Figure 3 is a cross-sectional view of the heater base component shown in Figure 1 along the line B - B in Figure 1;

Figure 4 is a top plan view of another embodiment of a base component of an asymmetric radiant electric heater according to the present invention in which a part-circular heating element is positioned to the left hand side of a circular heating element;

Figure 5 is a top plan view of a wall arrangement for use with the base components shown in Figures 1 and 4;

Figure 6 is a bottom plan view of the wall arrangement shown in Figure 5;

Figure 7 is a cross-sectional view of the wall arrangement shown in Figure 6 along the line C - C shown in Figure 6; and

Figure 8 is a top plan view of an embodiment of an asymmetric radiant electric heater according to the present invention in which the wall arrangement shown in Figures 5 and 6 is fitted to the base component shown in Figure 1.

[0019] Referring to Figures 1 and 2, an asymmetric radiant electric heater is constructed, starting with an oval metal dish-like support 1 having a long axis of symmetry 2 and a short axis of symmetry 3.

[0020] A base layer 4 of well-known microporous thermal and electrical insulation material is provided in the support 1 and has an upwardly-extending peripheral region 4A.

The base layer 4 may be dished so as to provide a greater distance between the surface of the base layer and the plane in which the peripheral region 4A terminates in the central region of the base than in the peripheral region thereof.

[0021] At least one first heating element 5 is arranged in substantially circular configuration on the base layer 4 and at least one second heating element 6 is arranged in substantially part-circular configuration, adjacent the first heating element 5, on the base layer 4. The heating elements 5 and 6 can comprise any of the well known materials, such as wire, ribbon, foil or film materials. In particular, the heating elements 5 and 6 may be of corrugated ribbon form and may be supported edgewise, in well known manner, on the base layer 4.

[0022] A terminal block 7 is arranged at a fixed location at an edge of the dish-like support 1. The terminal block 7 is secured at the edge of the dish-like support 1 on the short axis of symmetry 3.

[0023] Heating element 5 has end portions 5A and 5B electrically connected to terminals 8 and 9 respectively of the terminal block 7 and heating element 6 has end portions 6A and 6B electrically connected to terminals 9 and 10 respectively of the terminal block 7. Thus, terminal 9 is common to both heating elements 5 and 6.

[0024] The terminals 8, 9, 10 of the terminal block 7 may be connected to a voltage supply (not shown) such that heating element 5 is energisable alone, or together with heating element 6. Terminal 9 of the terminal block 7 is connected to the voltage supply by way of a well-known form of rod-like temperature-responsive device 23 which extends from the edge of the dish-like support 1 partly across the heating element 5.

[0025] As shown in Figure 4, a base component for a heater may be constructed up to the same stage as that of Figure 1 with the exception that, whereas the arrangement of Figure 1 has the substantially part-circular heating element 6 situated at the right hand side of the circular heating element 5, the arrangement of Figure 4 has the substantially part-circular heating element 6 situated at the left hand side of the circular heating element 5.

[0026] Both forms of heater base component are constructed using a common form of dish-like support 1, with base layer 4, only the configuration of the heating elements being different, as required for different user applications, such as in glass-ceramic cooking appliances.

[0027] A wall arrangement 11 of thermal insulation material, as shown in Figures 5, 6 and 7, is provided for adding to the base components of Figures 1 and 4 to produce finished heaters. The wall arrangement 11 is constructed of bound vermiculite, suitably comprising exfoliated particles of vermiculite bound with potassium silicate. The wall arrangement 11 is symmetrical about the long axis.

[0028] The wall arrangement 11 is arranged for supporting on the base 4 of insulation material of the base component of the heater and comprises a peripheral wall 12 for extending around the heater, and an integral dividing wall 13 for extending between the first and sec-

ond heating elements 5 and 6. Because the base 4 is dished, the dividing wall 13 extends downwardly in the central region by a greater distance than in the end regions thereof, by about 3 mm. The wall arrangement is stepped so that an outer rim 12A of the peripheral wall is supported by the upper surface of the upwardly-extending peripheral region 4A.

[0029] Recesses 14 and 15 are provided in the peripheral wall 12 and the dividing wall 13 in the region of the ends of the dividing wall 13, at a lower edge of the wall arrangement 11. When the wall arrangement is fitted to the base component of the heater of Figure 1, the recess 14 at the end of the dividing wall 13 allows the end portions 5A, 5B of the first heating element 5 and the end portions 6A. 6B of the second heating element 6 to pass under the wall for connection to the terminal block. In this orientation of the wall arrangement 11, the corresponding recess 15 at the other end of the dividing wall 13 overlies, and is substantially filled by, a protrusion 16 provided on the surface of the base layer 4 of insulation material directly opposite to where the electrical connections to the terminal block 7 are provided. The protrusion 16 is suitably formed integrally with the base layer 4.

[0030] A pair of matching elongate projections 17 and 18 are provided directly opposite each other on opposite lower edges of the outer rim 12A of the peripheral wall 12 of the wall arrangement 11 (Figure 7). The projection 17 is arranged to bear upon the terminal block 7 of the base component of Figure 1 while the projection 18 is accommodated in a substantially complementary elongate recess 19 provided in the upwardly-extending peripheral region 4A at the edge of the base layer 4 of insulation material.

[0031] Figure 8 shows a finished heater in which the wall arrangement 11 of Figures 5 to 7 is fitted to the base component of Figure 1 and first and second heating zones 20 and 21 are formed in the heater.

[0032] The wall arrangement 11 of Figures 5 to 7 also fits, without modification, the heater base component of Figure 4. The heating elements 5 and 6 of Figure 4 comprise a mirror image arrangement of the heating element 5 and 6 of Figure 1. The wall arrangement 11 is fitted to the base component of Figure 4 in an orientation which represents 180 degrees of rotation of the wall arrangement about an axis perpendicular to a base 22 (Figure 2) of the dish-like support 1, compared with the orientation when fitted to the base component of Figure 1 (that is, mirrored about a vertical plane through the short axis of the oval heater). When the wall arrangement is fitted to the base component of Figure 4, the recess 15 at the end of the dividing wall 13 accommodates the end portions 5A, 5B of the first heating element 5 and the end portions 6A, 6B of the second heating element 6, while the corresponding recess 14 at the other end of the dividing wall 13 overlies, and is substantially filled by, protrusion 16 provided on the surface of the base layer 4 of insulation material.

[0033] Elongate projection 18 on the lower edge of the outer rim 12A of the peripheral wall 12 of the wall arrangement 11 bears on the terminal block 7, while the corresponding projection 17 at the opposite side of the outer rim of the peripheral wall 12 is accommodated in recess 19 provided at the edge of the base layer 4 of insulation material.

Claims

1. An asymmetric radiant electric heater with multiple heating zones which can be arranged in a plurality of configurations, the heater comprising:

   a dish-like support (1) having two orthogonal axes of symmetry (2, 3);

   a base (4) of thermal and electrical insulation material in the dish-like support;

   a first heating element (5) and a second heating element (6) supported adjacent one another on a major surface of the base and forming an asymmetric arrangement in the dish-like support;

   a terminal block (7) secured at a fixed location at an edge of the dish-like support; and

   a wall arrangement (11) of thermal insulation material supported on the base and comprising a peripheral wall (12) extending around the heater and a dividing wall (13), integral therewith, extending between the adjacent first and second heating elements (5, 6) to form at least two asymmetric heating zones;

   characterised in that
   the wall arrangement (11) is adapted and arranged to cooperate with the base (4) and the terminal block (7) whereby the wall arrangement is fitted to the heater in a first position to accommodate a first configuration of the adjacent first and second heating elements (5, 6) and in a second position, representing 180 degrees of rotation of the wall arrangement from the first position about an axis perpendicular to a base of the dish-like support, to accommodate a second configuration comprising a mirror image arrangement of the adjacent first and second heating elements (5, 6).

2. A heater as claimed in claim 1, **characterised in that** the dish-like support (1) is of substantially oval shape.

3. A heater as claimed in claim 1 or 2, **characterised in that** the first heating element (5) is of substan-

tially circular configuration and the second heating element (6) is of substantially part-circular configuration.

4. A heater as claimed in claim 1, 2 or 3, **characterised in that** the dish-like support (1) has a long axis of symmetry (2) and a short axis of symmetry (3) .

5. A heater as claimed in claim 4, **characterised in that** the terminal block (7) is secured at the edge of the dish-like support (1) on the short axis of symmetry (3).

6. A heater as claimed in claim 4 or 5, **characterised in that** the wall arrangement (11) has a long axis of symmetry corresponding to the long axis of symmetry (2) of the dish-like support (1).

7. A heater as claimed in any preceding claim, **characterised in that** the base (4) of thermal and electrical insulation material is dished.

8. A heater as claimed in claim 7, **characterised in that** the lower edge of the dividing wall (13) is profiled to correspond to the dish-shape of the base.

9. A heater as claimed in any preceding claim, **characterised in that** a recess (14, 15) is provided in the peripheral wall (12) at each end of the dividing wall (13) at a lower edge of the wall arrangement to selectively accommodate electrical connections between the terminal block (7) and one or more of the first and second heating elements (5, 6).

10. A heater as claimed in claim 9, **characterised in that** a protrusion (16) is provided on the surface of the base (4) of thermal and electrical insulation material directly opposite to where the electrical connections to the terminal block (7) are provided and cooperating with an overlying one of the recesses (14, 15) at the end of the dividing wall (13) to substantially fill such one of the recesses.

11. A heater as claimed in any preceding claim, **characterised in that** a pair of matching elongate projections (17, 18) are provided directly opposite each other on opposite lower edges of an outer rim of the peripheral wall (12) of the wall arrangement (11), one of the projections being arranged to bear on the terminal block (7), the other of the projections being accommodated in a substantially complementary recess (19) provided in the base (4) of thermal and electrical insulation material.

12. A heater as claimed in any preceding claim, **characterised in that** a rod-like temperature-responsive device (23) is provided at least partly crossing one of the heating zones.

13. A heater as claimed in any preceding claim, **characterised in that** the wall arrangement (11) comprises bound vermiculite.

14. A heater as claimed in any preceding claim, **characterised in that** the base (4) comprises microporous thermal and electrical insulation material.

15. A heater as claimed in any preceding claim, **characterised in that** the first heating element (5) and the second heating element (6) comprise wire, ribbon, foil or film material.

16. A heater as claimed in claim 15, **characterised in that** the first heating element (5) and the second heating element (6) comprise corrugated ribbons supported edgewise on the base (4) of thermal and electrical insulation material.

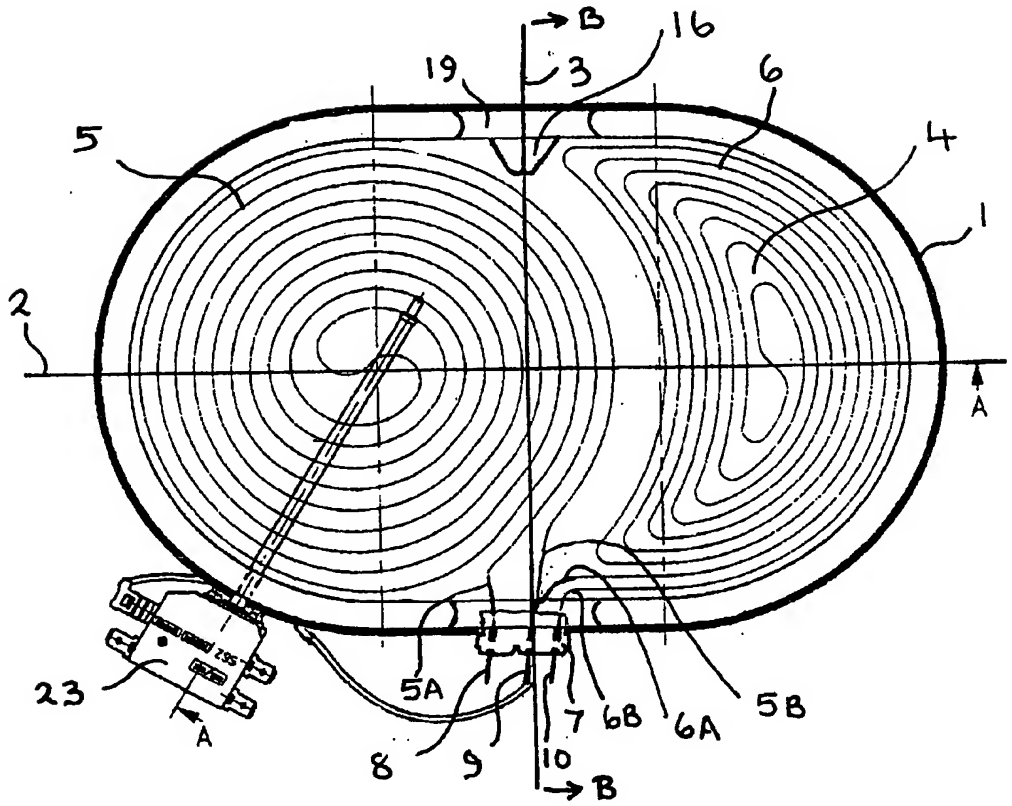

FIG. 1

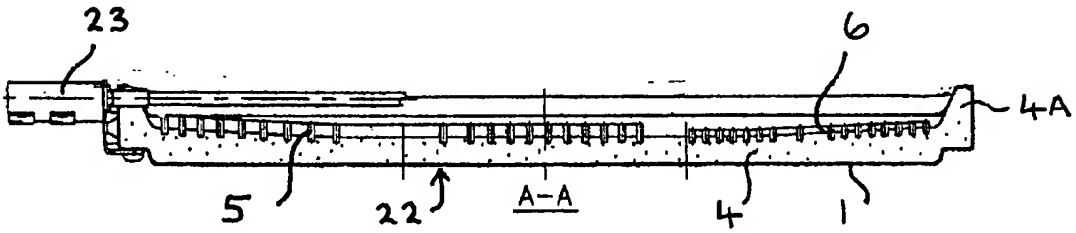

FIG. 2

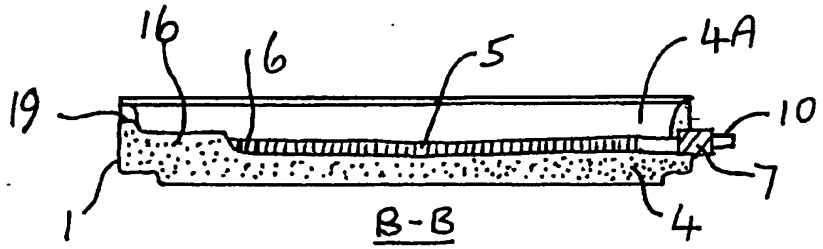

FIG. 3

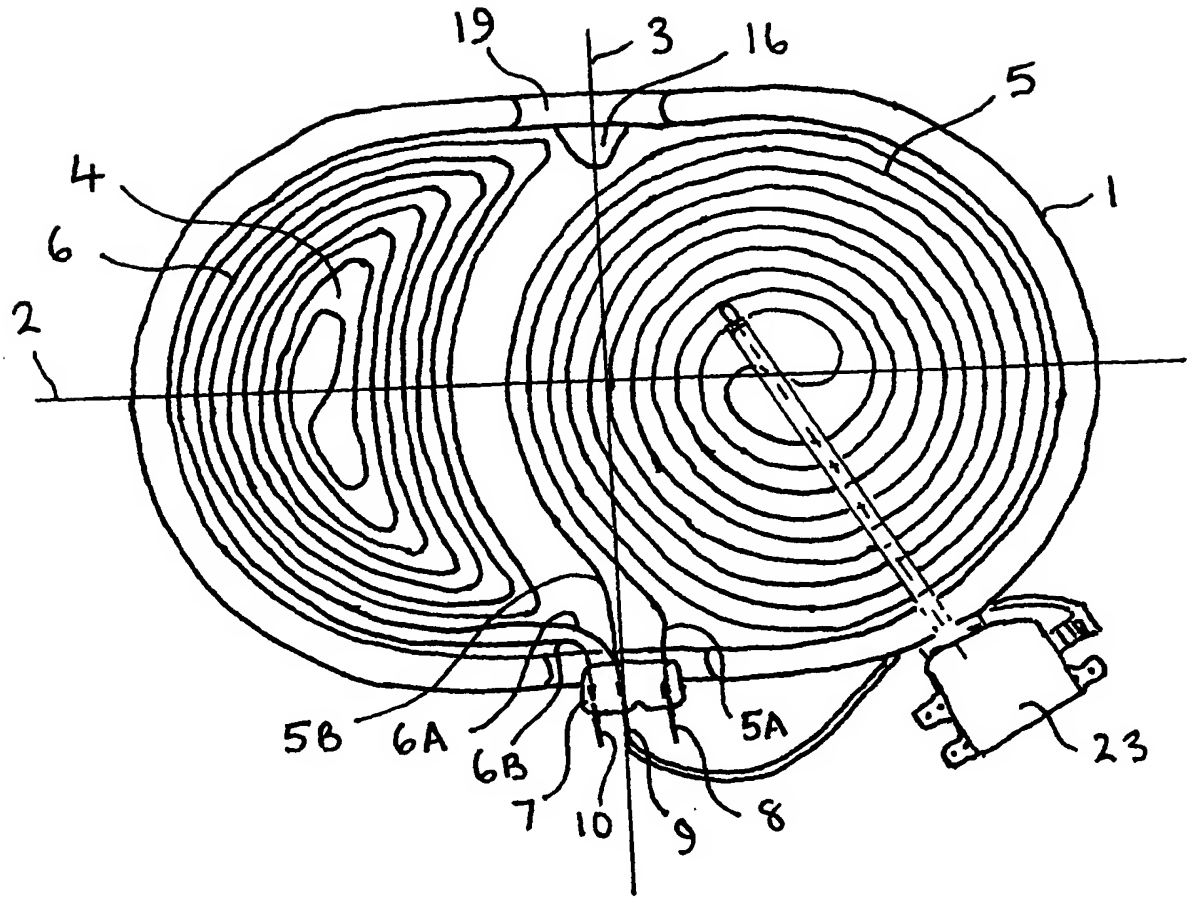

FIG. 4

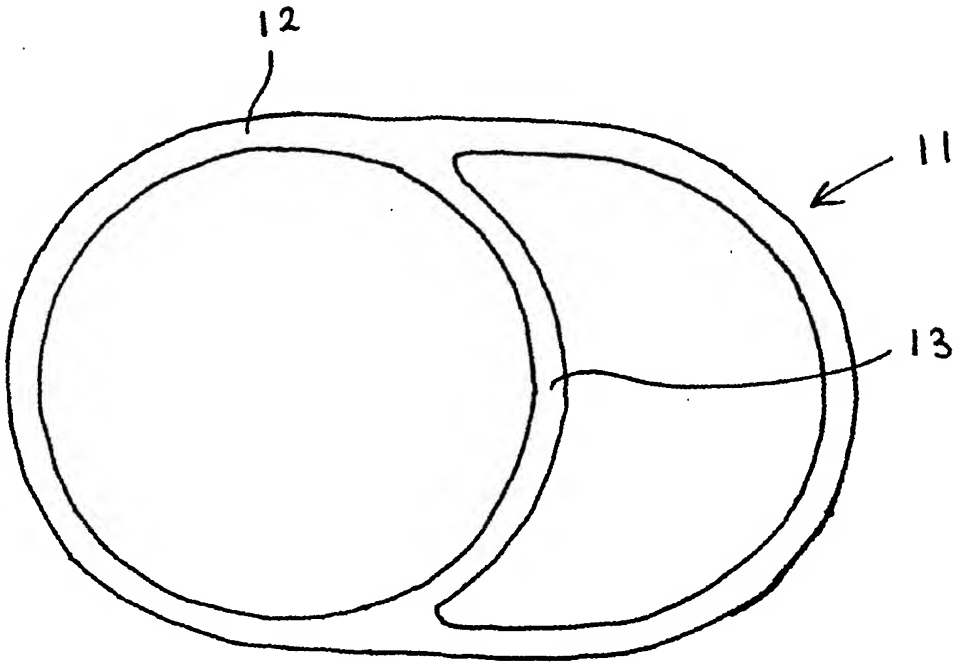

FIG. 5

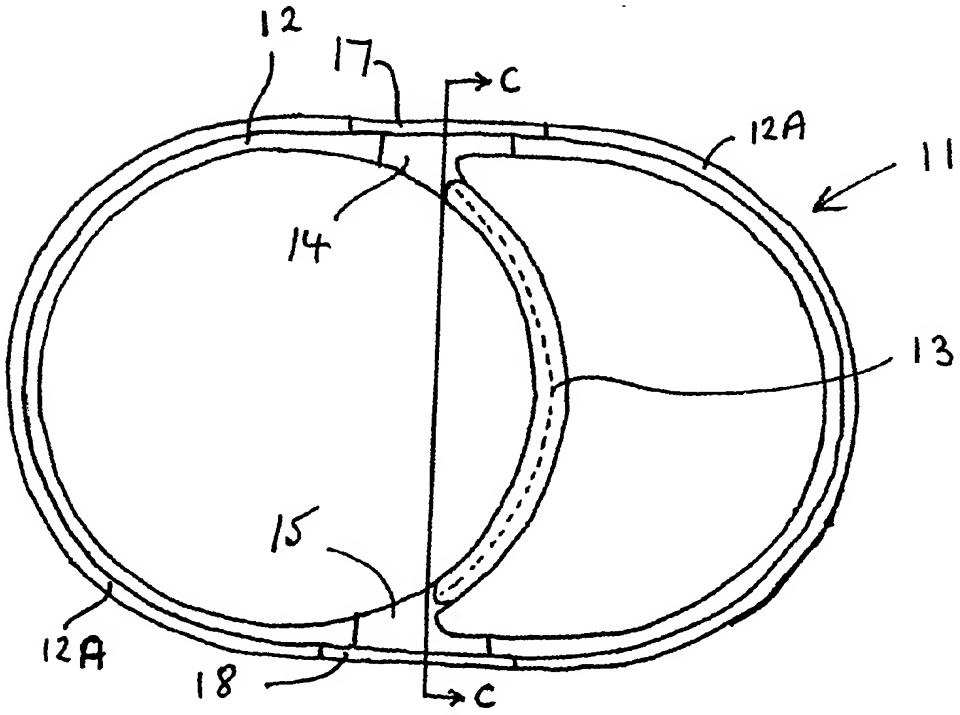

FIG. 6

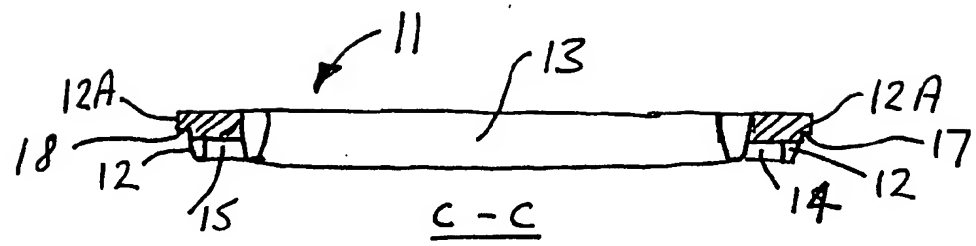

FIG. 7

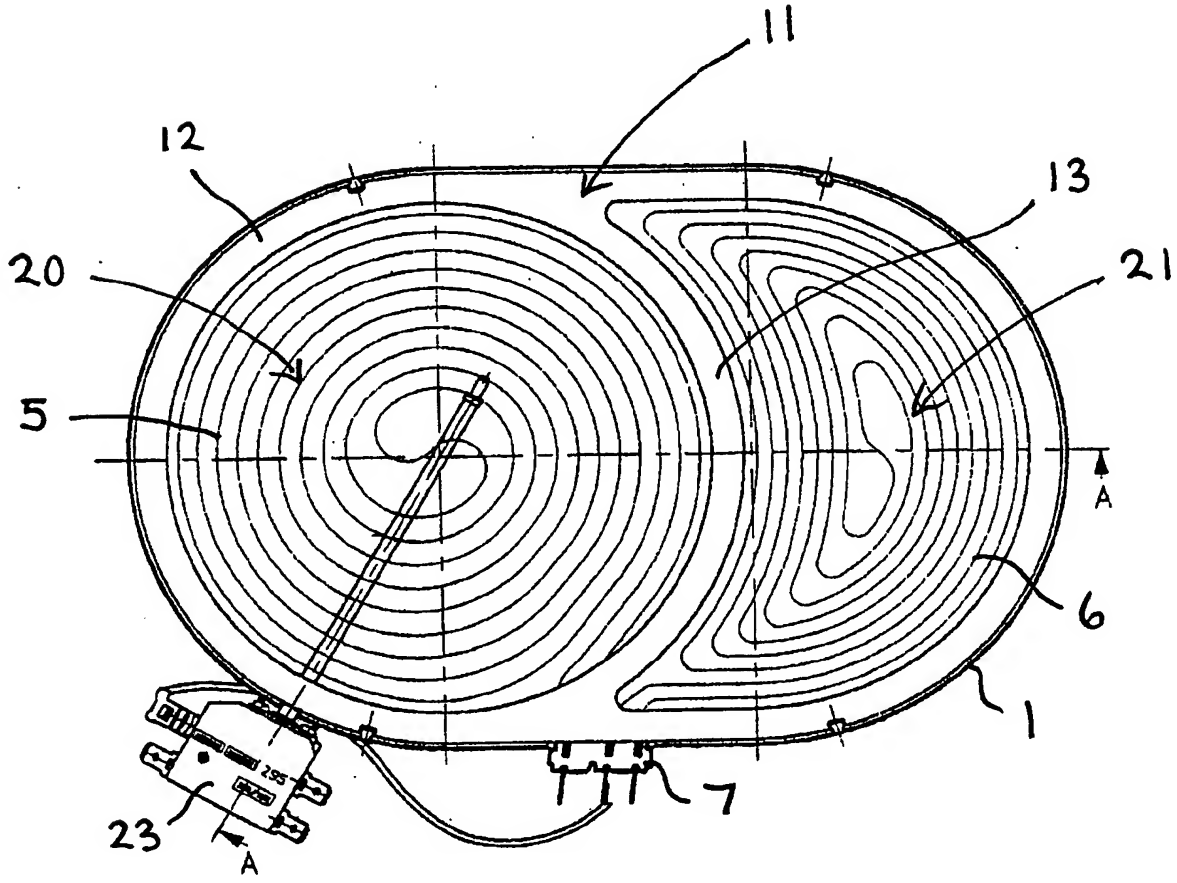

FIG. 8